Meeting National Environmental Goals: Coordinated Federal IT Solutions

David B. Nelson, Ph.D.

Director

National Coordination Office for

Information Technology Research and Development

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EPA 2003 Science Forum

Networking and Information Technology Research and Development (NITRD) Program

- Coordinated, focused long-term interagency R&D in information technologies
- Evolved from the Federal HPCC, CIC, NGI, and IT R&D programs
- $2 billion multi-agency NITRD Program
  - 12 agencies and departments coordinated via a “virtual agency” coordination/management structure
    - AHRQ, DARPA, DOE/NNSA, DOE/SC, EPA, NASA, NIH, NIST, NOAA, NSA, NSF, ODDR&E
  - Coordinated by the National Coordination Office for Information Technology Research and Development
- Assessed by the President’s Information Technology Advisory Committee

NITRD Program Coordination

WHITE HOUSE

Executive Office of the President
Office of Science and Technology Policy

National Science and Technology Council

President's Information Technology Advisory Committee (PITAC)

U.S. Congress

NITRD Authorization and Appropriations Legislation

National Coordination Office (NCO) for Information Technology Research and Development

Interagency Working Group (IWG) on Information Technology R&D

Participating Agencies: AHRQ, DARPA, DOE/NNSA, DOE/SC, EPA, NASA, NIH, NIST, NOAA, NSA, NSF, ODDR&E

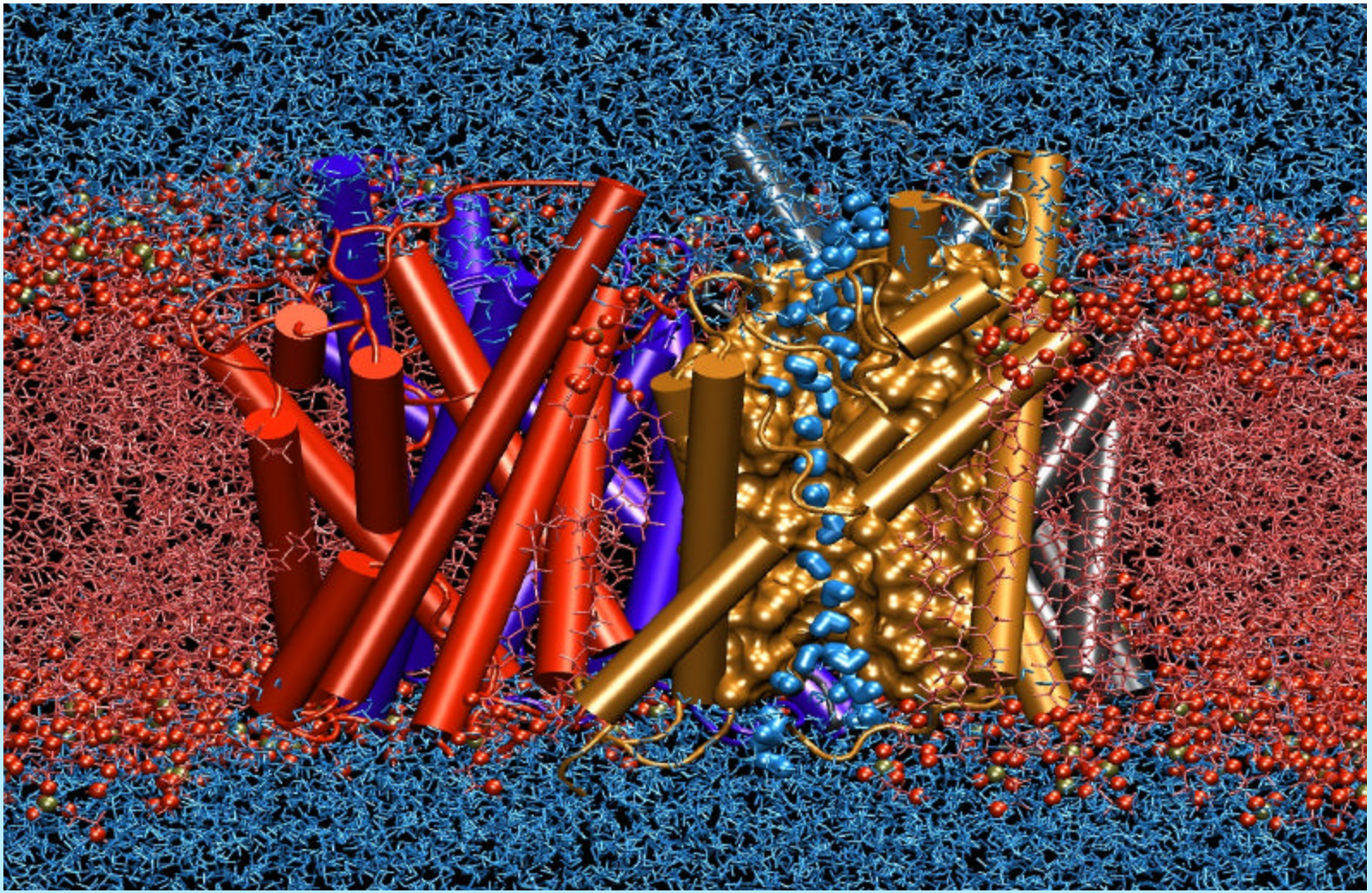
- **High End Computing Coordinating Group (HEC)**
- **Large Scale Networking Coordinating Group (LSN)**
- **High Confidence Software and Systems Coordinating Group (HCSS)**
- **Human Computer Interaction & Information Management Coordinating Group (HCI & IM)**
- **Software Design and Productivity Coordinating Group (SDP)**
- **Social, Economic and Workforce Implications of IT and IT Workforce Development Coordinating Group (SEW)**

Examples of Environment-Related Information Technology Research

- **Simulation of Aquaporin Protein inside a Cell (NSF, NIH)**
- **Environmental Modeling of the Chesapeake Bay (NOAA, EPA, DoD)**
- **High Resolution, Long-Term Climate Modeling (DOE, NSF, NOAA)**
  - Comparison with Earth Simulator (Japan)
- **“Smart Dust” (DoD, Intel)**

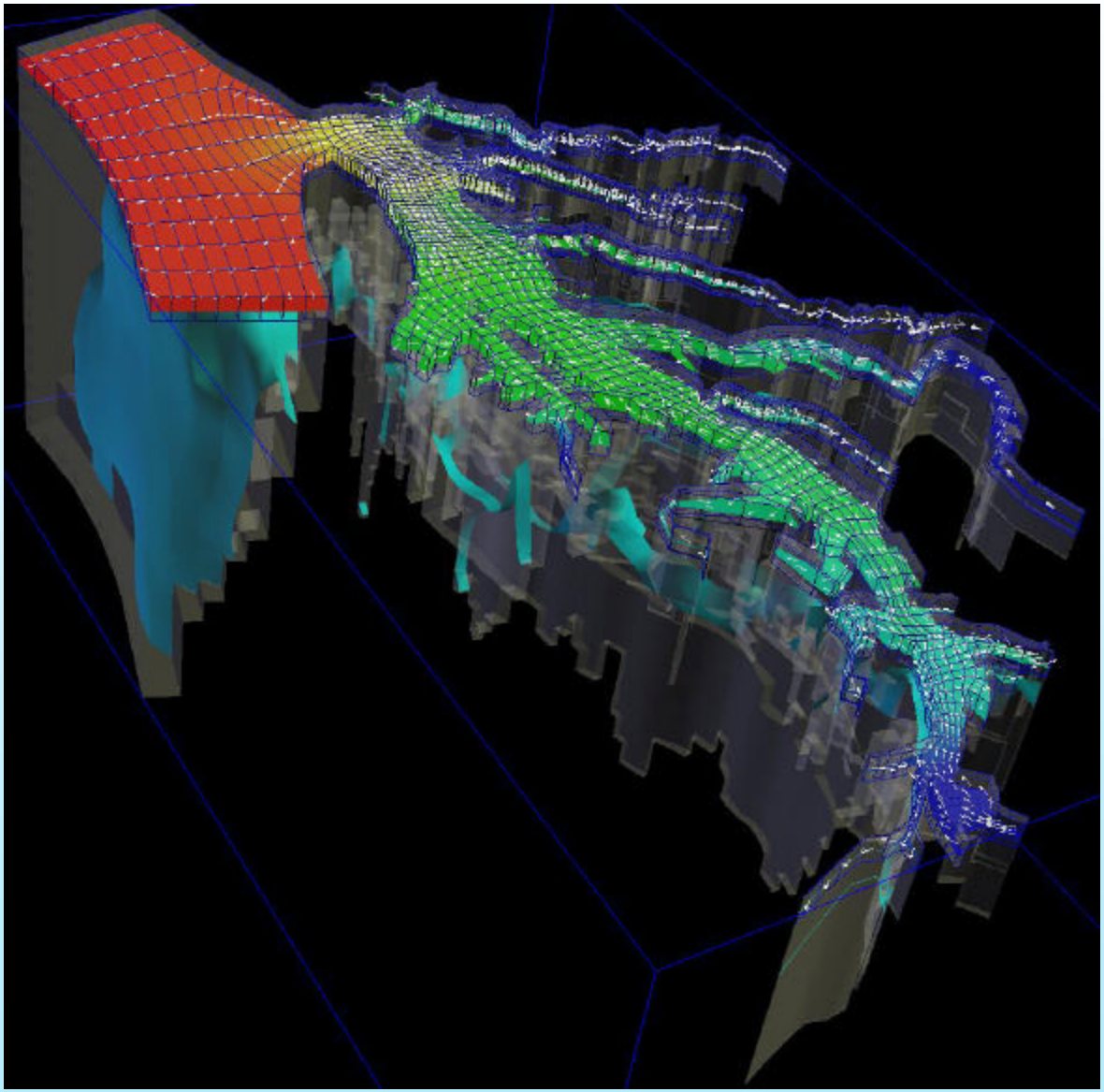
Simulation of Aquaporin Protein Inside a Cell (NSF & NIH)

Visualization shows transport of water molecules into cell.



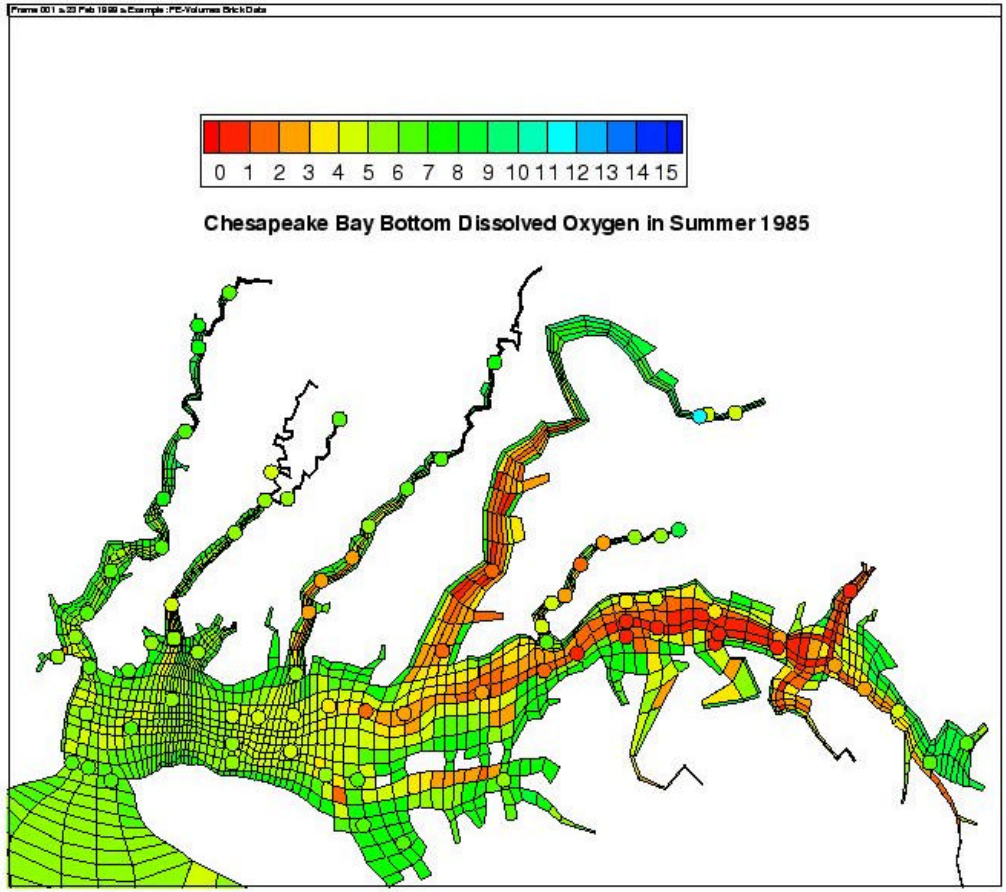
Environmental Modeling of the Chesapeake Bay (NOAA, EPA, DoD)

- Image shows visualization of computed salinity in the Bay (red is high salinity.)
- South is up.
- Visualization is an important part of the model, because users may not be skilled computational scientists.



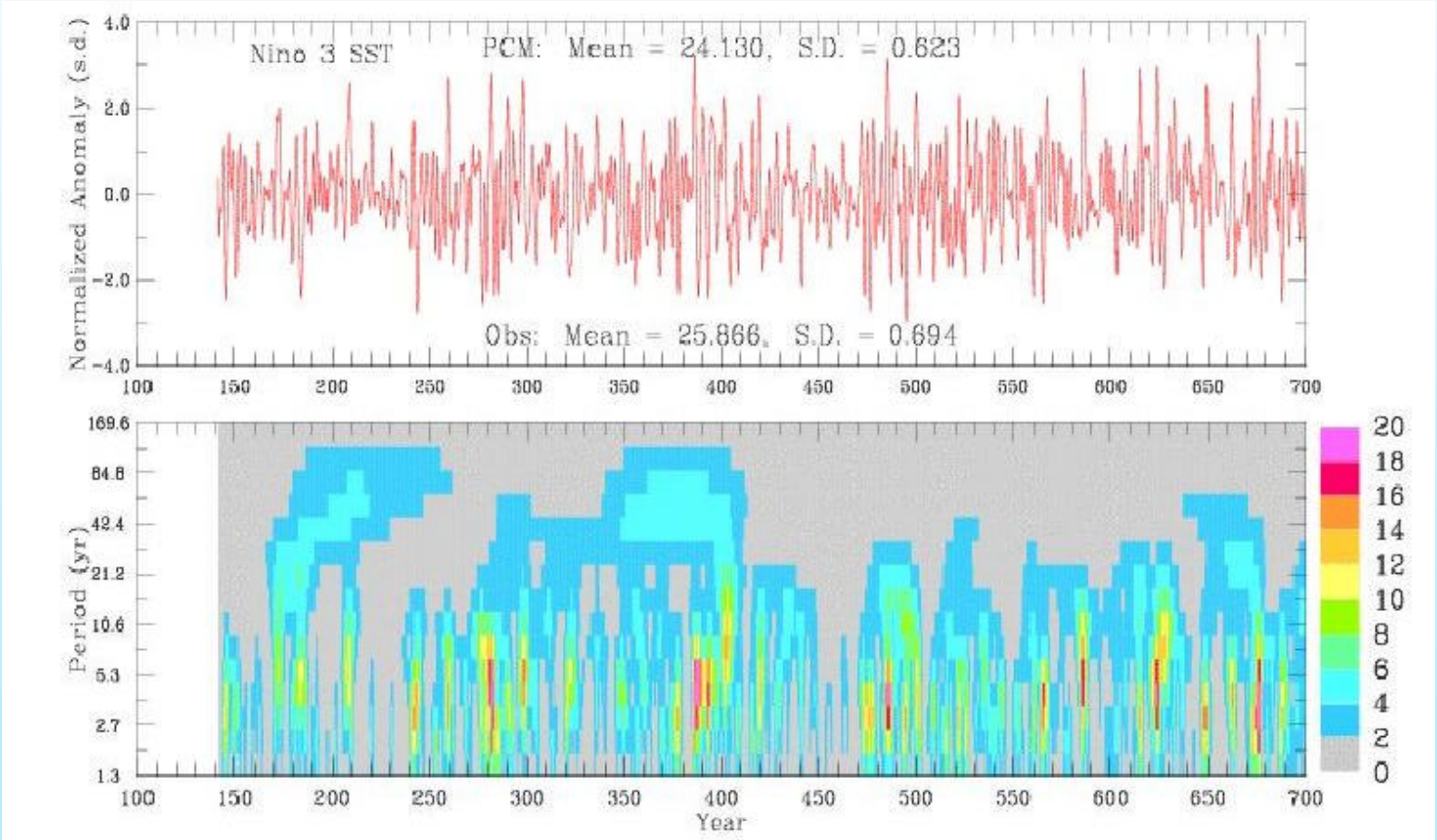
Environmental Modeling of the Chesapeake Bay (NOAA, EPA, DoD)

- Model is checked against measured data
- Model has shown that approximately 1/4 of the nitrogen added to the Bay starts as air pollution, some from sources hundreds of miles from the Bay's watershed.



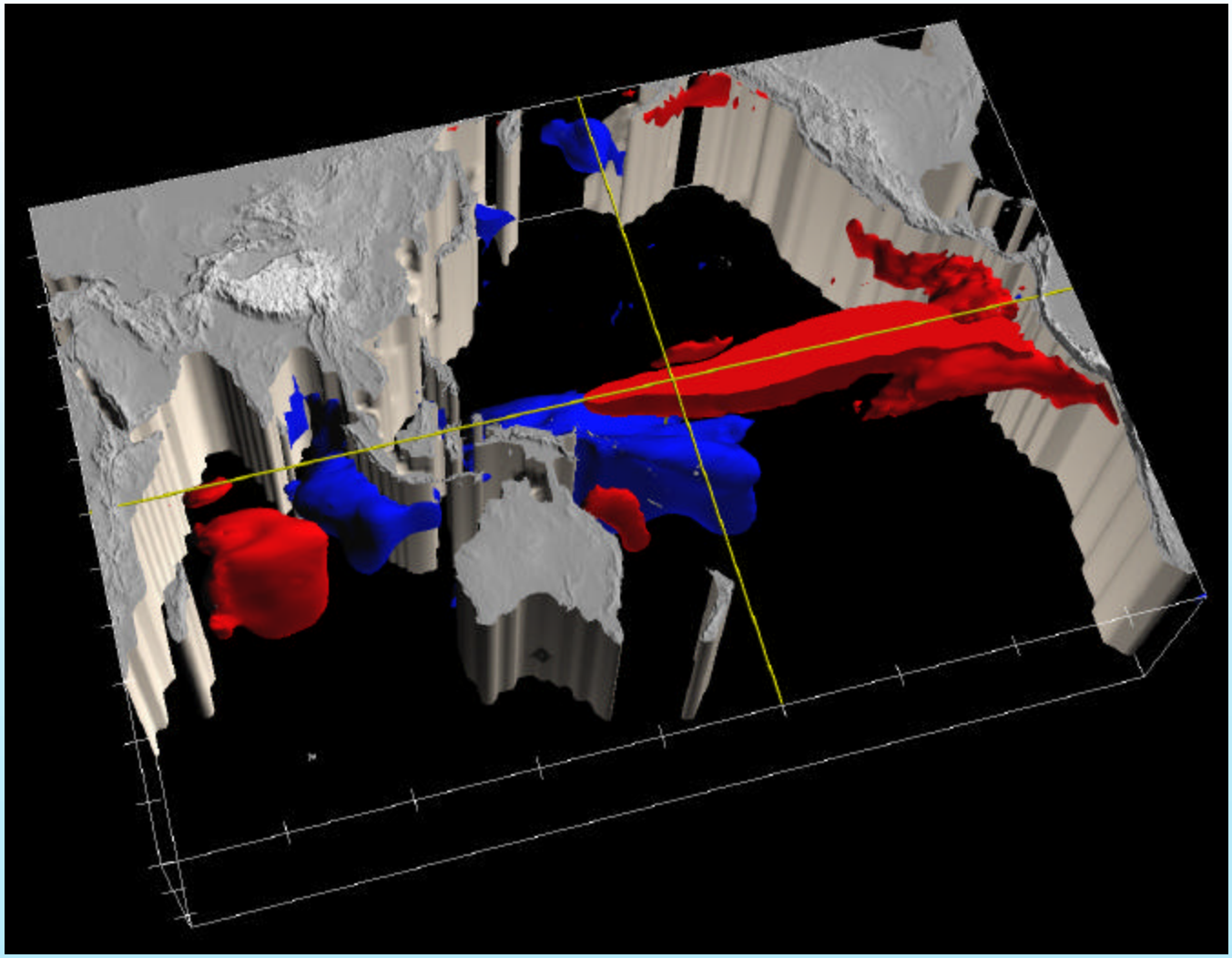
1200 Year Control Run of Parallel Climate Model El Niño Results (DOE, NSF, NOAA)

- El Niño shows large variability at decadal to centennial time scales.
- Interpretations of greenhouse gas-forced runs should be put in context of control run.



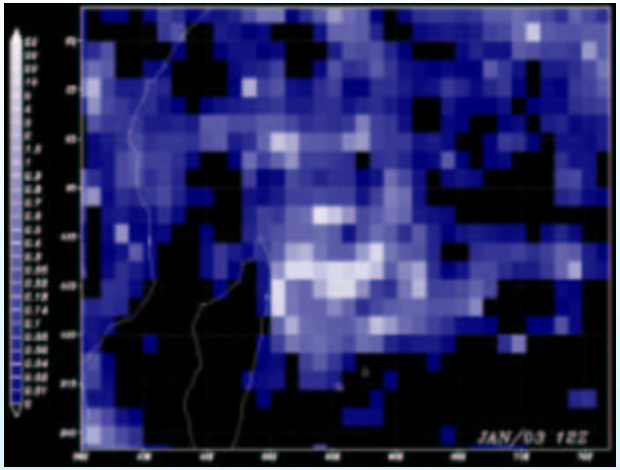
Visualization of El Niño

- El Niño is an accumulation of warm water in the Southern Eastern Pacific Ocean

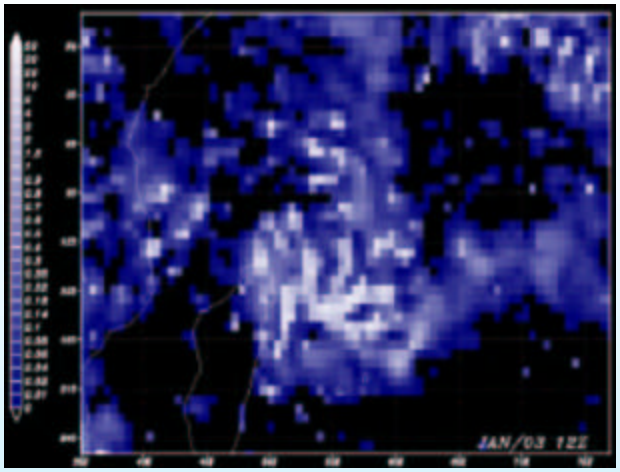


Power of Japanese Earth Simulator Allows Better Resolution of Local Features

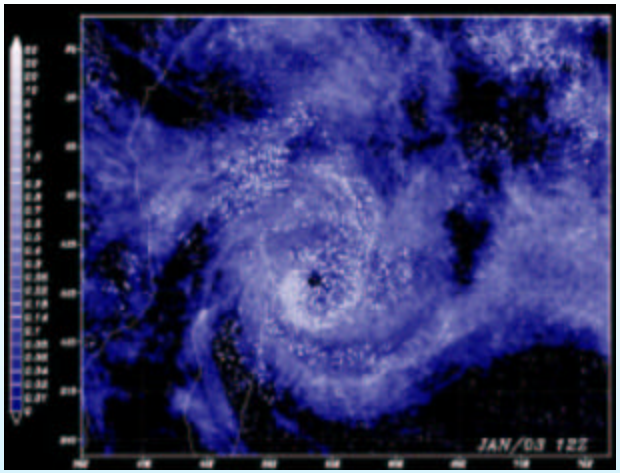
Simulation of Tropical Cyclone Near Madagascar



125.1 km grid



62.5 km grid



10.4 km grid

(U.S. 1200 year control run used approximately 280 km grid.)

"Smart Dust"

- **UC Berkeley Project sponsored by DoD and Intel**
- **Near-Term goal: millimeter sized sensor and communication package**
  - RF, laser, modulated corner reflector
  - Temperature, humidity, pressure, light intensity, magnetic field, acceleration
- **Could be used for environmental monitoring or surveillance**
- **Experiment: air dropped swarm that spotted and tracked vehicles**
  - Magnetometer, self organizing rf network, Tiny OS

Other Examples of Environmentally-Relevant IT Research

- Combustion modeling to reduce emissions
- Transport modeling of toxic plumes
- Hydrology models of surface and ground water
- Networks of real-time sensors to detect toxic chemicals or biologicals
- Digital libraries of mass spectral prints for chemical compounds
- Models of biological activity of toxic chemicals
- Information on genetic mutations due to chemicals
- Etc.

For Further Information

Please contact us at:

nco@itrd.gov

Or visit us on the Web:

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